

# The 'INCA' Study: Respiratory Muscle Weakness in patients with Chronic Heart Failure and the Effects of Heavy Duty Training of Inspiratory Muscles

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## Introduction

There are a few studies focusing on prevalence and clinical relevance of respiratory muscle dysfunction in patients with chronic heart failure (CHF).

## Aim

To assess the prevalence of pulmonary and respiratory muscle impairments in patients with CHF, and the clinical effects of inspiratory muscle training (IMT) using heavy duty loading.

## Methods

65 patients (68±11 yrs.; NYHA status II-III) with left systolic dysfunction have been studied (figure 1).

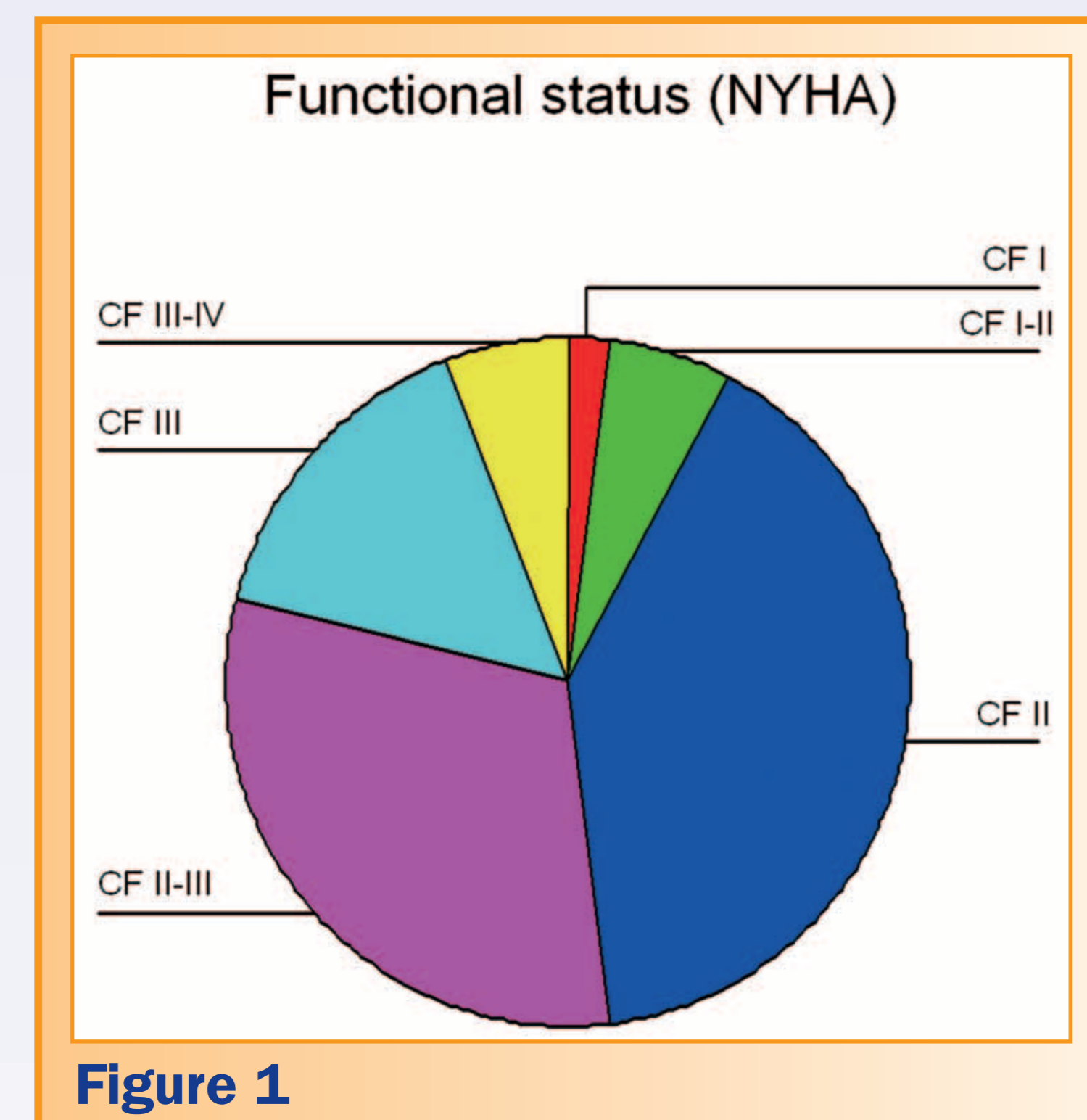
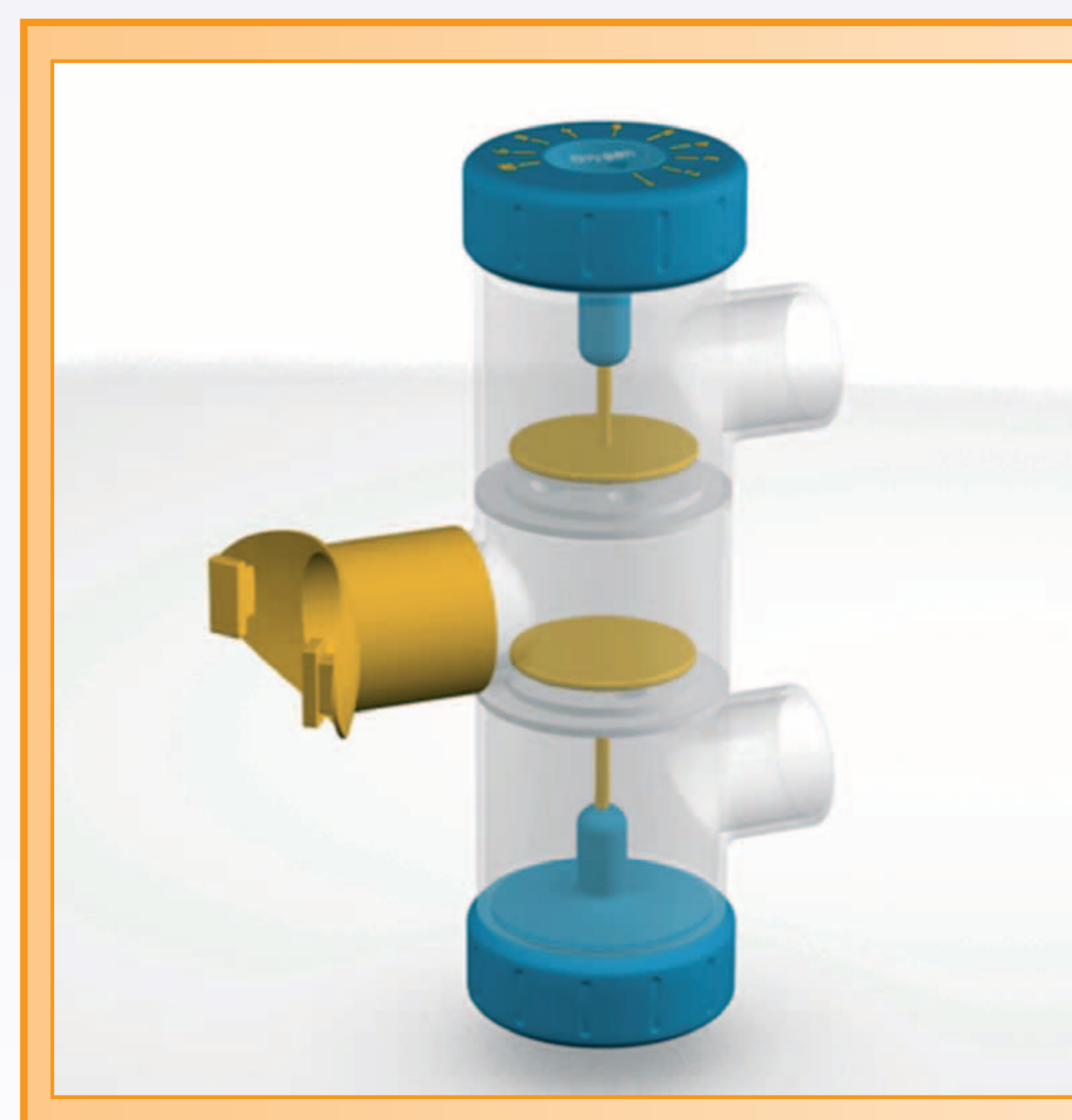


Figure 1

- **Cross sectional study:** Pulmonary function test (PFT), respiratory muscles (P<sub>lmax</sub>, P<sub>Emax</sub>), and peripheral muscle functions were assessed.
- **Clinical trial:** Training was conducted in a subgroup of patients who received a heavy-duty IMT defined as 3 weeks of heavy inspiratory loading (10 insp/5 series/twice a day) using a threshold inspiratory pressure device (Orygen Dual® threshold valve) (figure 2).



**FIGURE 2: The Orygen Dual® Threshold valve was selected to induce the controlled external loads for the inspiratory muscle heavy duty training protocol.**

## Results

- At baseline conditions, 85% of patients showed impaired pulmonary function tests, with predominant obstructive ventilatory patterns.
- Respiratory muscle dysfunction was highly prevalent as shown by a decreased P<sub>lmax</sub> and P<sub>Emax</sub> in 93% and 84% of patients, respectively (figure 3).

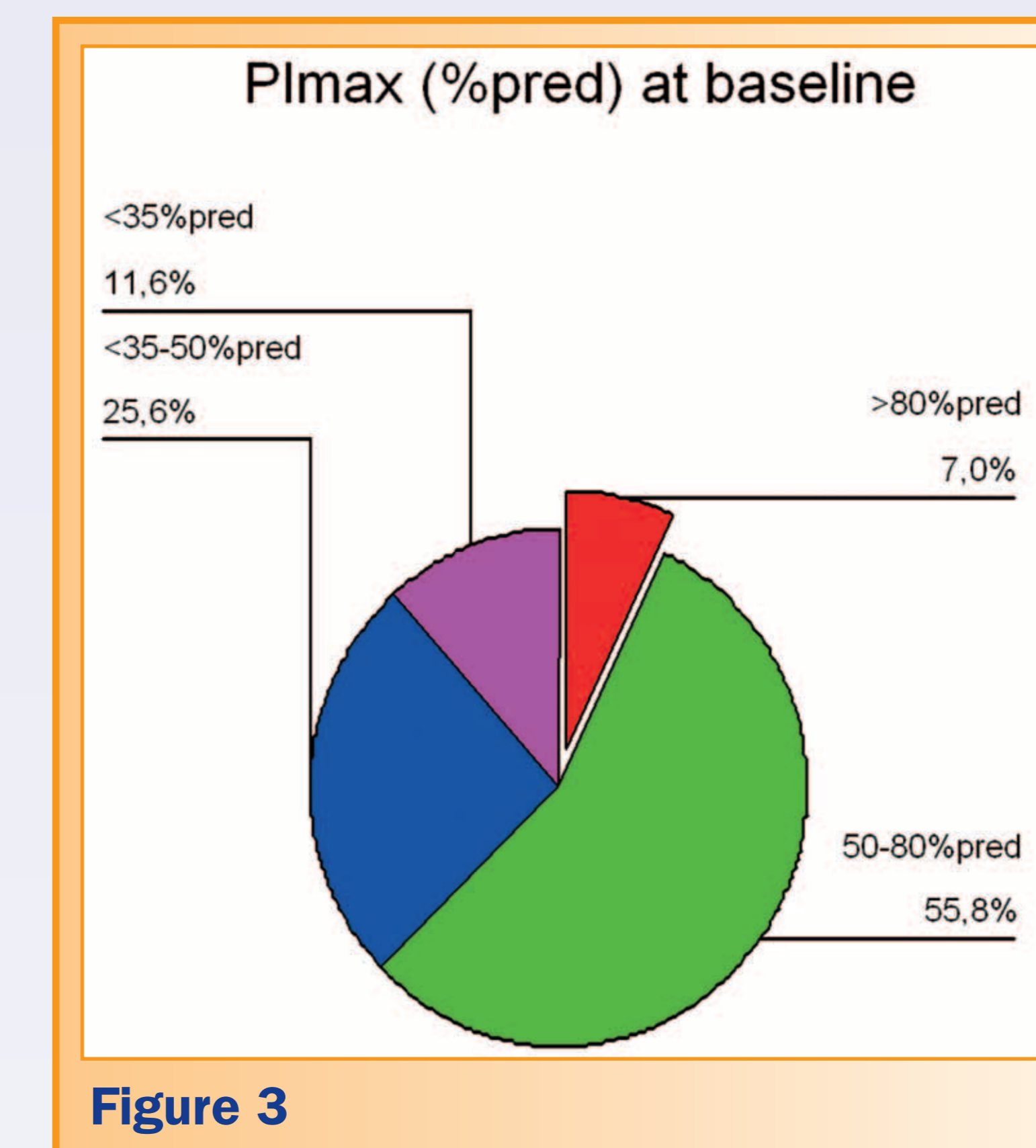
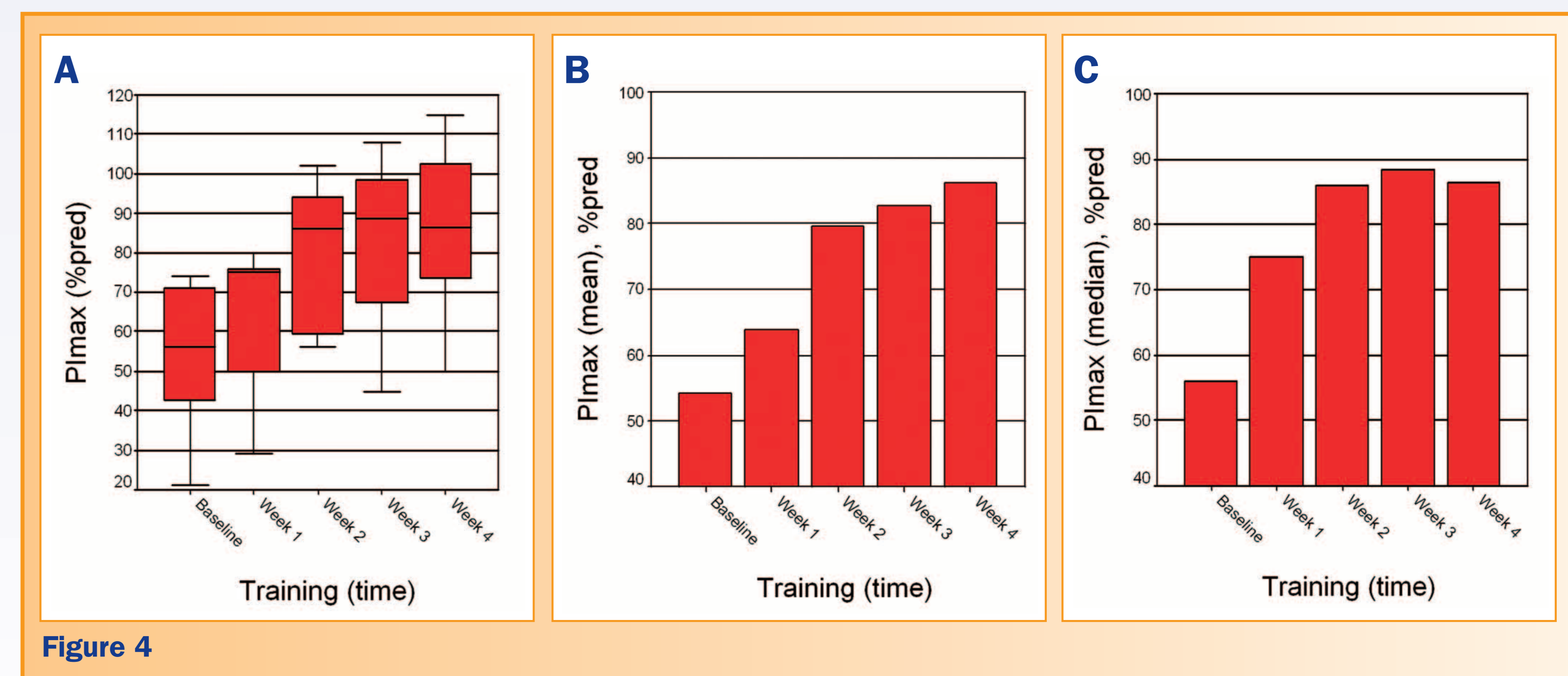


Figure 3

- Inspiratory muscle training resulted in an increased P<sub>lmax</sub> (=+21±11 cmH<sub>2</sub>O; p<0.001). In 66% of patients, P<sub>lmax</sub> values following training reached normal values (>80% pred) (figures 4a, b and c).



## Conclusions

- Impaired pulmonary and respiratory muscle functions are very common in CHF patients.
- A specific-short and high intensity IMT is safe and able to induce significant improvements of inspiratory muscle strength.
- This study highlights the importance of include both pulmonary and respiratory muscle assessments in the comprehensive treatment of patients with CHF

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